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## THE ENTOMOLOGICAL SOCIETY OF VICTORIA (Inc)

### MEMBERSHIP

Any person with an interest in entomology shall be eligible for Ordinary membership. Members of the Society include professional, amateur and student entomologists, all of whom receive the Society's News Bulletin, the Victorian Entomologist.

### OBJECTIVES

The aims of the Society are:

- (a) to stimulate the scientific study and discussion of all aspects of entomology,
- (b) to gather, disseminate and record knowledge of all identifiable Australian insect species,
- (c) to compile a comprehensive list of all Victorian insect species,
- (d) to bring together in a congenial but scientific atmosphere all persons interested in entomology.

### MEETINGS

The Society's meetings are held at La Trobe University, 2<sup>nd</sup> Floor, Room 2.29, 215 Franklin Street, Melbourne (Opposite the Queen Victoria Market) Melway reference Map 2F B1 at 8 p.m. on the third Friday of even months, with the possible exception of the December meeting which may be held earlier. Lectures by guest speakers or members are a feature of many meetings at which there is ample opportunity for informal discussion between members with similar interests. Forums are also conducted by members on their own particular interest so that others may participate in discussions.

### SUBSCRIPTIONS

Ordinary Member	\$20.00 (overseas members \$22)
Country Member	\$16.00 (Over 100 km from GPO Melbourne)
Student Member	\$12.00
Associate Member	\$ 5.00 (No News Bulletin)

Associate Members, resident at the same address as, and being immediate relatives of an ordinary Member, do not automatically receive the Society's publications but in all other respects rank as ordinary Members.

Cover design by Alan Hyman.

Cover illustration of the Blue Triangle butterfly, *Graphium sarpedon* L. by Rhonda Millen.

## MINUTES OF THE GENERAL MEETING, 19 OCTOBER, 2001

Meeting opened 8.03 pm.

**Present:** A. Kellehear, C. Peterson, G. Weeks I. Endersby, D. Stewart, R. MacPherson, R. McMahon, J Tinetti, P. Carwardine, , D. Dobrosak, C. Dobrosak, L. Garnett, M. Hurley, M. Endersby, K. Dunn, P. Grey, E Grey, L. Cookson, R. Vagi, M. Kesavan.

**Apologies:** A. Glaister, K Yee.

**Minutes:** Minutes of the general meeting 15/8 /01 were accepted. M: P. Carwardine  
S: R. MacPherson.

### **Treasurer's Report:**

- Account balances arc: General account \$6089; Le Souëf account \$3580.

### **Editor's Report:**

- Articles are in hand but more are welcome.

### **Correspondence:**

- Circular 93 from the Society for Insect Studies (NSW) was tabled.
- Notification of winners of bursaries for the Science talent Quest were received. The major bursary winner was Catherine Simpson of Genazzano College for her Developments in Biodiversity. Sarah Mitchell and Emma Thornton won the minor bursary for their poster on Insect Communication. The bursaries will be awarded at Latrobe University next Monday.

### **Speaker:**

Dr Tim New from Latrobe University spoke on the Development of a National Action Plan for butterfly conservation and his work on the project. This Action Plan for Australian butterflies identifies butterfly species that are most deserving of conservation. Tim explained some of the taxonomic and ethical issues that confronted the project workers. He presented an overview of the processes followed and the criteria that were developed.

### **General Business**

1. Membership applications from M. Hurley and R. Wepler were confirmed.
2. Notice of a membership application from T. Dewhurst was given. This will be put forward for confirmation at the next meeting
3. This was Ray Macpherson's last meeting. Ray is moving interstate. The President thanked Ray for his active membership of the Society, and noted especially his work as a council member and his memorable contributions to show and tell. We look forward to receiving Ray's promised article and hope that he will visit meetings on return trips to Melbourne.
4. Excursion reminder : Meet at 10am Sunday Nov 25<sup>th</sup> at Ocean Grove Foreshore Reserve. Take the dirt road near the information centre. BYO everything please.
5. Negotiations re accommodation at the Museum are continuing.
6. I. Faithfull has identified the specimen sent in by Ms. Levens as a wasp in the genus *Isodontia*. Details have been forwarded to the sender.

Meeting closed 9.25pm

## Wing Colour Dominance Within *Erina (Candalides) hyacinthina* (Semper) (Lepidoptera: Lycaenidae)

R. GRUND

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The butterfly species *Erina (Candalides) hyacinthina* (Semper) (after Tite 1963) currently comprises three recognised subspecies (Braby 2000, Williams and Bollam 2001), that have similar male genitalia, and similar wing colour morphology on the undersides of the wings. The nominotypical subspecies and the recently described subspecies *E.h. gilesi* (Williams and Bollam 2001) have dark purple coloured wing uppersides in the adults, while the subspecies *E.h. simplex* (Tepper) has blue coloured wing uppersides. The nominotypical subspecies occurs in the high rainfall coastal and Great Dividing Range areas in the eastern states of Australia, with an extension into the Lower Southeast of South Australia. Subspecies *E.h. gilesi* occurs in the extreme southwest of Western Australia, while subspecies *E.h. simplex* occurs over a large part of southern temperate Australia. The three subspecies do not fly together, and in New South Wales they are separated by *Erina gemina* (Edwards and Kerr). In the southwest part of Victoria the race *E.h. josephina* (Harris 1952) was proposed to account for an unusual lilac coloured adult form, which is presently treated as a variable hybrid population occurring between the purple nominotypical subspecies and the blue coloured subspecies (Braby 2000). The lilac coloured form also exists in the Lower Southeast of South Australia.

The author, during studies on the larval foodplants of the nominotypical and the blue coloured subspecies in South Australia, noted that the principal foodplant of *E.h. simplex* is the parasitic dodder *Cassytha melantha* (Lauraceae), but that it would also utilise other dodders *C. peninsularis* and *C. flindersii* in more arid parts of South Australia. The nominotypical subspecies is restricted to *Cassytha pubescens*. An examination of the distributions of these dodders shows that *C. pubescens* is widespread in higher rainfall temperate South Australia and its range overlaps with *C. melantha*. The latter occurs in the lower rainfall temperate areas of South Australia, particularly mallee areas, as this dodder seems to have a parasitic association with mallee type eucalypts. By contrast *C. pubescens* seems to have a parasitic preference for non-eucalypt plants. It was also noted that the distribution of *E.h. simplex* is identical to the distribution of *C. melantha* (and its other two foodplants), whereas the nominotypical subspecies is restricted to areas of *C. pubescens* occurring outside of the distribution of the former dodders. This distributional enigma was particularly apparent in the Lower Southeast of South Australia where *C. melantha* does not occur.

A similar foodplant distribution differential also exists in southwest Western Australia. The foodplant of *E.h. gilesi* is *Cassytha racemosa* while the foodplant of *E.h. simplex* in adjacent areas is *C. melantha*. These two dodders have overlapping ranges over much of southwest Western Australia, except in the extreme southwest of Western Australia (Weber 1981), where only *C. racemosa* occurs, coincident with the distribution of *E.h. gilesi*.

As a follow up to this foodplant enigma in South Australia, the author undertook experiments in which eggs of the nominotypical and the blue coloured subspecies were obtained from adult populations occurring in the Southeast of South Australia, and the hatched larvae then fed on dodders that were not their usual foodplants. Larvae of *E.h. simplex* were given *C. pubescens* to eat while larvae of nominotypical *E.h. hyacinthina* were given *C. melantha* to eat. The larvae of *E.h. simplex* quickly died, whereas larvae of nominotypical *E.h. hyacinthina* developed normally into flying adults.

The results of the experiments suggest that the range in South Australia of *E.h. simplex* is indeed, likely confined to the distribution of its presently known foodplants. One possible conclusion from this, is that at some time in the evolutionary past, the ancestral population of *Erina hyacinthina*, probably a purple race, spread from its forest and wet woodland habitat into the developing dry woodland habitat that started evolving at the end of the Miocene Epoch (5 my BP) (White 1990) to utilise the similarly evolving *C. melantha*. In doing so the butterfly also acquired the blue colour to the wing uppersides. Divergence of the two races did not reach total species separation, and the gene controlling the blue wing colour became dominant over the gene controlling purple wing colour. During the recent past (presumably), as the dry mallee woodland encroached into the wet woodland the two races became juxtaposed again. The blue *E.h. simplex* race would have remained confined to the dry woodland and the occurrence of its *C. melantha* foodplant, while the purple race could not coexist with the blue race even though it could feed on *C. melantha*, as interbreeding would suppress the purple wing colour due to the dominance of the gene controlling blue wing colour. The lilac coloured form (*E.h. josephina*) probably represents the actively hybridising zone but where the gene for blue wing colour does not completely suppress the purple colour.

However, this possible outcome does not entirely fit the distribution pattern of the foodplants and *E. hyacinthina* in eastern New South Wales and eastern Victoria, where both *C. melantha* and *C. pubescens* significantly overlap in their range (Weber 1981) yet only the nominotypical race of the butterfly exists ! Are more than one variety of *C. melantha* involved or is the occurrence of *C. melantha* in these areas too isolated for *E.h. simplex* to access ? or does the gene(s) for wing colour operate differently in these areas ??

Never the less, it would now seem that the various colour races of *E. hyacinthina* should now be considered colour form varieties rather than distinct, isolated geographical subspecies.

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## Courtship Behavior in Three Queensland Butterflies

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### Summary

Observations of courtship refusal in *Psychonotus caelius* (C. Felder) (Lycaenidae) and *Suniana sunias* (C. Felder) (Hesperiidae), and partial courtship in *Melanitis leda* (L.) (Nymphalidae) in southeastern Queensland are detailed. A courtship of *S. sunias* is compared with an earlier account. Courtship refusal signals and courtship interference at oviposition sites are discussed in relation to hesperiids, polyommata blues, and other Australian butterflies. Some polyommata use similar refusal signals to hesperiids.

### Courtship observations in SE Queensland

#### NYMPHALIDAE

##### *Melanitis leda* – Preliminary courtship observations

Locality: Griffith University campus at Nathan Qld.

Habitat: vine thicket - woodland ecotone adjacent Mimosa creek

Date: 18 March 1993 at 6:04pm EST (1804h)

Weather: sun obscured by cumulo-nimbus clouds, approaching twilight with fading light, 24°C.

Female first seen in woodland, flying about 40-50cm above ground, some 30-40m away. She was flying steadily, but unhurried, towards observer. As she approached, a male fluttered alongside at similar height, slightly to the left, and then slowed to align about 20cm behind female. Male now aligned behind female, dropped height slightly (not estimated at time, but probably within 30cm), and continued to fly close beneath female at constant distance behind. Adults had flown about a metre farther, now travelling at speed of about a brisk walking stride (hurried flight).

Male, still beneath, increased speed flying to about 10cm in front (but still below), then slowed until about 20cm behind her. This behavior was repeated several times over a distance of about 5-10m (involving several seconds). This created the visual effect of the male flying back and forth, in an arc, below the moving female. Female, now aware of pursuing male, commenced evasive flight or escape manoeuvres. She instantly turned sharply to the left (at about 45 degrees) for about two seconds, and then darted to the canopy (at about angle of about 75 degrees to the horizontal) approaching the upper foliage of a tall Eucalypt at high speed. Male quickly followed. Both adults now silhouetted flying together above eucalypt. Still pursued, female dived rapidly (at about 75 degrees), and simultaneously dropped behind tree line. Both lost from view about 30m away to the left.

It is possible that mating or a refusal took place soon after return to ground level. The pair could not be tracked through the dense understorey scrub, especially in fading light, to confirm subsequent activity. Total time involved about one minute.

## LYCAENIDAE

### *Psychonotus caelius* - Courtship Observations

Locality: Griffith University campus at Nathan Qld.

Habitat: woodland near Mimosa Creek.

Date: 15 February 1993 at 1:53pm EST (1353h)

Weather: fine, cirrus cloud cover. Site in filtered sunlight during sunny break.

The following behavior took place in direct sunlight on a tree leaf, situated about three metres above ground. Observations were made from a small ridge that enabled a view of the butterflies from above. Total time involved about three minutes.

Fairly fresh female of *Psychonotus caelius* (formerly *Danis hymetus*) flew about three metres above ground near *Alphitonia excelsa* tree. Male in reasonable condition approached. Female immediately adopted fluttery flight, keeping wings largely horizontal, exposing white upperside patterns. She flew slowly in this manner for about 20 centimetres, then settled on leaf of nearby tree. Male hovered behind and above female. Male remained at about 45cm away. Female rapidly flicked wings in fanning motion. Male then settled on same leaf. He selected a site towards her rear, about one centimetre away. Male remained only briefly as female continued wing flickering. Male then flew off. Female did not depart with male, but continued to flick wings, then remained still with wings closed.

About 20 seconds later a second male flew into the area. He was first observed about one metre away. As the male was about to continue on past resting female, he abruptly changed direction by about 75 degrees and flew straight to settled female. Male began to flutter in hovering flight. Male continued to hover back and forth, about four to five centimetres behind and about three centimetres above her.

Female responded by rapidly flicking wings, and male settled, another two males appeared simultaneously, both now hovering and fluttering behind female. Settled male then returned to flight. Three males now fluttered behind settled female. One settled again, near her and the other two males departed. Female continued to flick her wings for a few more seconds, then both adults remained still with wings closed. Both faced east. Female then departed by normal flapping flight (not fluttering style). Male turned on leaf to face south and after about five more seconds, departed.

## HESPERIIDAE

### *Suniana sunias* - Courtship Observations

Locality: Griffith University campus at Nathan Qld.

Habitat: degraded vine thicket near woodland adjacent Mimosa Creek.

Date: 23 August 1993 at 1:43pm EST (1343h)

Weather: fine, 24°C.

Male intercepted female as she flew above *Leersia hexandra*. Female immediately settled on upper leaf of this grass, and commenced rapidly fluttering of wings. Male quickly settled behind, and made three attempts to mate. This was done by crawling aside, to her left. Male's head now level with the thorax of female. Male laterally curled abdomen to right in a 180° arc, and attempted to contact

female abdominal end and connect genitalia. During procedure, female maintained wing fluttering. Male then moved to about three centimetres behind female and remained stationary with wings partly opened. Female remained still with wings closed above thorax. About 20 seconds later male closed wings, and again remained still. As the female seemed reluctant to fly, she was disturbed by light antennal contact with grass. Female rapidly departed area of larval hosts, but after also taking flight, male returned to perched again nearby on leaves of *L. hexandra*. It seemed the female departed too quickly for the male to track her.

### Courtship signals and behaviorist theories

Females of many butterfly species have special visual rejection behaviors that cause males to leave or cease courtship. North American lepidopterist, James Scott (1973) documented eight rejection behaviors, comprising dances and poses, but concluded that there seemed no taxonomic correlation in this behavior, except for the pierid rejection posture. Wing fluttering by settled females seems a common refusal signal in Australian skippers (Atkins 1988, Dunn 1992, 1993). In support of this, Atkins (1997) documented an example in the subfamily Trapezitinae where no flutter signal was given and mating occurred immediately. Wing flicking also seemingly serves as a refusal signal in *P. caelius* and probably many other polyommatae lycaenids. Tennent (1987) observed wing flicking by a female *Cyaniris* (Polyommatae) in Morocco, which resulted in a courting male subsequently ignoring her. Scott defined the rapid flapping of wings as a general refusal signal seen over broad taxonomic levels.

The fact that in many species unreceptive females perform rejection dances, while receptive females remain quiescent argues for the presence of female pheromones (Scott 1973). In some species, different behavior has been noted between virgin, freshly mated, and older females in the absence of any visual cues given by the female. The settling of the *S. sunias* male with his head level with the female thorax was probably to facilitate mating, but may also have enabled detection of fanned chemicals drawn up by air currents towards the male's antennae. Scott reported that female scent glands are usually located near the end of the abdomen and probably occur in most species, but male pheromones are believed to be present in only 50% of species. The initial landing position of the males of both *S. sunias* and *P. caelius* behind the female (the *S. sunias* later walked up alongside) also convincingly argues the presence of pheromone-emitting glands in females of both species. Observations of refusal in *Toxidia peron* (Dunn 1992) also support this. In contrast, the male *S. sunias* reported earlier by Dunn (1993) did not land, but briefly hovered above the fanning female on each of three separate courtship attempts. This male probably detected fanned pheromones in flight, and accepted the refusal signal.

The male of *S. sunias* in this paper seemed more aggressive than the male documented previously (Dunn 1993). In spite of refusal signals, this male landed and attempted to copulate three times by making probing genital contact with the female. This persistent probing may represent preliminary stages of attempted rape (given her refusal). The male's failure to couple, though, suggests this species needs some accommodation by the female for successful coitus. Nevertheless, his perseverance at coitus was traded off against time available to seek a more receptive female and the defence of territory. Perhaps this female was highly unreceptive, however in *Hypolimnas bolina* (Nymphalinae) even some unmated females departed after courting males abdominally probed them, but mated after three or more recommenced courtships by the same suitor (Rutowski 1992). There has been strong evolutionary selection for persistent males in butterflies. Obviously, males that can entice mildly unreceptive females to mate achieve more matings and produce more offspring (Scott 1973). It is believed that some female butterflies even assess male vigour through initial rejection behavior (Rutowski 1979). In species where there is frequently mild female resistance, the selective force will move towards sexually aggressive and more persistent males.



On this occasion the male *S. sunias* remained settled for a short time during the female's post-refusal rest. In three other documented courtships in this skipper, the male quickly departed each time she signalled refusal (Dunn 1993). Post-refusal rests by females can last from one to several minutes (Dunn 1993). Although the female was intentionally alarmed to hasten her departure, it seems she would not normally depart until the male has first departed (Dunn 1993). The male often departs more or less immediately, and the rest-period allows time for him to exit the immediate area, avoiding repeated courtships by the same individual. Male lingering behavior has also been seen in other hesperiines. For example, Crosby and Dunn (1989) illustrated a lingering male of *Ocybadistes walkeri* settled behind a post-refusal female. Again, this male may have been re-analysing female abdominal pheromones dispersed by wing fluttering before he finally departed, or perhaps was slyly waiting for her to depart to recommence courtship as a seemingly new fancier.

### Male territories and courtship interference at sites of oviposition

All three courtships took place at or near oviposition sites. In the two refusal observations, the courted females settled on or near their respective larval hosts. No doubt these females had already mated, and were in the vicinity for the purpose of oviposition. Establishment of territories by males overlooking or very near larval hosts is a familiar strategy among many hesperiids. Some examples I have discussed in earlier communications in the *Victorian Entomologist* include *Cephenes*, *Toxidia*, *Suniana*, and *Trapezites*. *Panara* seems an exception.

Among the Polyommatinae, Grund (2001) recently reported hundreds of male *Nacaduba biocellata* flying beneath larval hosts seeking newly emerged females. Adults of this butterfly usually perch on the larval hosts (pers. obs.), but I once noted this same phenomenon in the arid inland. During the morning of 19 Aug. 1979 at Heavitree Gap near Alice Springs NT, numerous (uncountable) males of *N. biocellata* were seen patrolling very low over the ground, in shade, below several mulga bushes. I have not seen other Australian polyommatines patrolling similarly, but many do establish territories by perching near oviposition sites. Incidentally, the larvae of the African *Azanus ubaldus* feed on desert *Acacia* spp. (Tennent 1996), and the adults are somewhat reminiscent of *N. biocellata* and may exhibit parallel, beneath-host, patrolling behavior.

A cost to establishing territories near oviposition sites is the time wasted investigating and courting many gravid females. If male harassment is intense, gravid females may instead oviposit on more isolated or boundary hosts away from the main male aggregations, focussed within the richer breeding areas. In some site tenacious theclines, females after mating may become sedentary and visit larval hosts when male territoriality has declined, such as late in the day (eg. *Hypochrysops piceata* – see Dunn & Kitching 1994). Some mainland satyrines have climatic strategies that result in oviposition occurring very late in the season when most males have died (eg. *Heteronympha merope*). Female aestivation ends in autumn, optimally timed for the new growth of perennial hosts in response to rainfall (Edwards 1973). Conveniently, interference from courting males is close to negligible, and becomes non-existent during late autumn at low altitudes in Victoria where females are still active (pers. obs.). Oviposition then occurs unimpeded.

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## Some Records of Arboreal Carabid Beetles in Tasmania

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### Introduction.

One of the carabid communities which has received scant attention is that associated with the bark of eucalypts. In Australia this arboreal community consists of approximately 500 species in eight subfamilies, a quarter of the total number of carabid species in Australia. (Baehr, 1990). In Tasmania the proportion of under bark specialists is similar with 55 species out of 225 described carabid species. (Semmens *et al*, 1992).

### Methods.

Collections of arboreal carabids were made using two techniques.

At Bell Bay in northern Tasmania sticky paper bands 20cm wide were stapled on several species of *Eucalyptus* and *Acacia* in differing stages of health. Three trees each of *E. globulus*, *E. ovata*, *E. camaldulensis* and *Acacia dealbata* were selected. Two healthy and one declining in each tree species. The declining eucalypts all had attack by the cerambycid *Phoracantha mastersii* to the lower bole while the *A. dealbata* had suffered severe fireblight (*Acacicola orphanana*) damage. The waxed paper strips coated with 'Tangle-Trap' (The Tanglefoot Company, Grand Rapids, USA) were wrapped around the lateral branches and main stem of each tree. The sticky traps were stapled in position from early October 2000 to late May 2001 and were replaced at monthly intervals. Specimens were removed from the sheets and cleaned in 'De-Solv-it' (RCR International, Sandringham, Australia), a citrus based solvent, before mounting. The specimens have been lodged in the Tasmanian Forest Insect Collection (TFIC) in Hobart.

The intent was to capture timber insects (scolytids, cerambycids, anobids, etc.) including any exotic incursion species as part of a pest surveillance project.

Ad hoc collections of sub-cortical invertebrates have been made for several years from roadside eucalypts during travels around the State. The aim was to examine the overwintering claterid fauna sheltering under the bark of isolated rural eucalypts as part of a project on rural tree decline examining the impact on biodiversity. Loose bark around the base of the eucalypts was peeled back and the invertebrate fauna collected. This destructive sampling was time consuming and specimens escaped by falling into the litter at the base of the tree. Records from other tree hosts are from specimens in the TFIC collection.

### Results.

Table 1 lists the carabid species found associated with bark. Three of those species, *Homothus guttifer*, *Hypharpax australis* and *Paratrechodes macleayi* are not strictly arboreal but since they were found on at least one occasion it appears they occasionally use the bark surface as a shelter or to find prey. The 19 species recorded represent 35% of the known Tasmanian arboreal carabid fauna. Within the arboreal fauna 21 are Tasmanian endemic species of which 12 are known only

from single locations. Only 3 endemic species were found in this study. One species, *Demitrida vittata*, is a new record for Tasmania (K. Michaels, *pers. comm.*).

**Table 1: The carabid species collected.**

**(1) Sticky traps at Bell Bay**

<i>Agonocheila curtula</i> (Erichson, 1842)	Lebiitae	
<i>Agonocheila bimaculata</i> Sloane, 1920	Lebiitae	Endemic
<i>Demitrida infuscata</i> (Chaudoir, 1872)	Lebiitae	Endemic
<i>Demitrida vittata</i> (Dejean, 1831)	Lebiitae	New Tasmanian Record
<i>Trigonothops pacifica</i> (Erichson, 1842)	Lebiitae	
<i>Trigonothops</i> sp. A.	Lebiitae	
<i>Trigonothops</i> sp. B.	Lebiitae	
<i>Sarothrocrepis benefica</i> (Newman, 1842)	Masoreitae	
<i>Sarothrocrepis civica</i> (Newman, 1840)	Masoreitae	
<i>Sarothrocrepis corticalis</i> (Fabricius, 1801)	Masoreitae	
<i>Sarothrocrepis gravis</i> (Blackburn, 1901)	Masoreitae	
<i>Homothes guttifer</i> Germar, 1848	Pterostichitae	
<i>Hypharpax australis</i> (Dejean, 1829)	Harpalitae	

**(2) Under bark collections**

<i>Agonocheila bimaculata</i> Sloane, 1920	Lebiitae	Endemic
<i>Agonocheila curtula</i> (Erichson, 1842)	Lebiitae	
<i>Agonocheila biguttata</i> Chaudoir, 1869	Lebiitae	
<i>Trigonothops pacifica</i> (Erichson, 1842)	Lebiitae	
<i>Trigonothops</i> sp.A.	Lebiitae	
<i>Sarothrocrepis civica</i> (Newman, 1840)	Masoreitae	
<i>Sarothrocrepis corticalis</i> (Fabricius, 1801)	Masoreitae	
<i>Sarothrocrepis gravis</i> (Blackburn, 1901)	Masoreitae	
<i>Sarothrocrepis inquinata</i> (Erichson, 1842)	Masoreitae	
<i>Amblytelus striatus</i> Sloane, 1920	Psydritae	Endemic
<i>Amblytelus curtus</i> (Fabricius, 1801)	Psydritae	
<i>Paratrechodes macleayi</i> (Sloane, 1920)	Trechitae	
<i>Adelotopus</i> sp.	Pseudomorphinae	

Table 2 illustrates the use of sticky traps for the detection of timber or arboreal insects. Both methods resulted in 13 species being collected. Sticky traps enable an estimate of how common a species is at a site and which tree species are preferred. For example large numbers of *Demitrida infuscata* were captured by sticky traps on two of the three eucalypt species over a three month period. Hand collecting on adjacent *E. globulus* trees for a one hour period yielded only 3 specimens of that species. The time to erect the sticky traps is a matter of minutes.

*Adelotopus* sp. was collected only from the rainforest tree *Nothofagus cunninghamii* from a tree killed by the platypus beetle, *Platypus subgranosus*.

Table 2: Carabid species captured by sticky traps and hand collection

Carabid species	Sticky traps			Hand collection										
	<i>Eucalyptus globulus</i>	<i>Eucalyptus carnaldulensis</i>	<i>Eucalyptus ovata</i>	<i>Acacia dealbata</i>	<i>Eucalyptus viminalis</i>	<i>Eucalyptus tenuiramis</i>	<i>Eucalyptus obliqua</i>	<i>Eucalyptus pulchella</i>	<i>Eucalyptus nitens</i>	<i>Acacia melanoxylon</i>	<i>Acacia dealbata</i>	<i>Nothofagus cunninghamii</i>	<i>Pinus sylvestris</i>	<i>Pinus radiata</i>
<i>Adeletopus</i> sp	9	3	7	2	2									
<i>Agonochelia bimaculata</i>	13	9	2	7			8			1				1
<i>Agonochelia curtula</i>	0	0	0	0				1						
<i>Agonochelia biguttata</i>	0	0	0	0							1			
<i>Amblytelus sinuatus</i>	0	0	0	0					1					
<i>Amblytelus curtus</i>	37	77	0	1	2		2							
<i>Demimda infuscala</i>	0	2	1	0										
<i>Demimda vittata</i>	0	0	1	0										
<i>Homoltes guttifer</i>	0	0	0	1										
<i>Hypharpax australis</i>	0	0	0	1										
<i>Sarothrocrepis benefica</i>	0	1	0	0										
<i>Sarothrocrepis chwica</i>	12	7	0	0	1					1				
<i>Sarothrocrepis gravis</i>	4	7	0	0						1				
<i>Sarothrocrepis corticalis</i>	1	1	0	0						1				
<i>Sarothrocrepis inquinata</i>							2							
<i>Trigonothops pacifica</i>	2	3	3	2	1									
<i>Trigonothops sp.A</i>	0	0	1	0				1						
<i>Trigonothops sp.B</i>	0	1	0	0										1
<i>Psaltrochodes macleayi</i>														

## Discussion.

Table 2 indicates that isolated relic trees in rural situations are valuable refugia for the arboreal carabids. These species are dependent on the presence of mature decortiating eucalypts. In recent decades the decline in number of rural trees has accelerated. The obvious impact to the rural community in loss of shade and shelter for stock as well as increased soil erosion has been well documented (Buchanan, 1989)(Heatwole and Lowman, 1986 ). The hidden loss in biodiversity is equally of importance given the high levels of endemism of many invertebrate groups dependent on eucalypts. This study demonstrates the importance of continued rural tree decline as one factor leading to reduced invertebrate biodiversity. The other factor seldom considered is that dead trees provide a long term habitat or overwintering site for many cryptic species. These trees are being removed to supply an urban firewood demand. On one hand we have agricultural practices resulting in increased dieback of mature trees and on the other hand removal of those dead trees for urban use. Tree dieback not only results in reduced tree cover but also the organisms which depend on those trees.

The technique of sticky trap sampling showed a much higher return in collection effort compared to the two other techniques. The main advantages being that the bark habitat is not destructively sampled and, being a continuous trap, seasonal traits of activity are revealed. The use of sticky traps for long term specific target monitoring of saproxylic and arboreal insects shows considerable promise for incursion detection. Forestry industry concerns over the introduction of damaging exotic timber pests and the increased port surveillance programs being introduced for their detection should consider the development of sticky traps as an economic and reliable monitoring tool.

## Acknowledgments.

My thanks to Dr Karyl Michaels (University of Tasmania) for the identification of many of the carabid species.

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## An Apparent Same-Sex Mating In Australian *Catopsilia* (Lepidoptera: Pieridae)

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### Summary

A hitherto unrecognised, spectacular, Australian example of an anomalous mating within the Pieridae has been found in the literature. Based on inferential data, it is argued that the *Catopsilia* copulation illustrated by Clyne (2000) is both interspecific and male intrasexual (same-sex). Several references dealing with same-sex courtship and coupling in the literature are mentioned and possible causes are tentatively suggested. It seems the number of publications reporting World field observations of anomalous sexual interactions over the last 140 years has remained relatively stable, but an unexpected peak at the turn of the 20<sup>th</sup> Century is evident.

### Introduction

After his recent observations of several mistaken couplings in Europe, North African butterfly taxonomist, John Tennent (1994) speculated that interspecific and intergeneric pairings, "are not as unusual as one might suppose and may even be commonplace." Indeed, behavioral ecologists would expect adapting species to make regular mistakes in courtship and mate selection during their ongoing descent with modification. They might mate with close or even distant species, producing variably infertile offspring or none relative to the degree of separation through time. Hybrid adults have been recorded from time to time, and sometimes named as new species (McAlpine 1970). Within some genera, and one or more undisputed, productively viable species, have been purported to be of ancient hybrid origin (Hancock 1991). Dunn (1996) discussed many irregular Lepidopteran couplings, including one same-sex example, but overlooked a number of interspecific and two same-sex pairings compiled earlier by Californian lepidopterists, Oakley Shields and John Emmel (1973). Because Dunn cited mainly contemporary sources (post 1973), there is little overlap between these two collations. Although the 1996 collation included none from the family Pieridae, three congeneric-interspecific (male-female) matings, involving *Colias* and *Pieris*, had been listed earlier by Shields & Emmel. Nevertheless, mistaken heterospecific copulations within this family seem less common than in other groups.

Compared with the seemingly commoner interspecific couplings, male-male courtships and same-sex matings have been very rarely documented. Such mistakes happen in Lepidoptera, but do not lead anywhere in evolutionary terms and would be selected against. Tennent (1987) observed an intraspecific, group-same-sex courtship in *Cyaniris semiargus maroccana* (Polyommatainae), including multiple attempted copulation by four individuals. One group involved up to eight males courting another newly eclosed male of the same species. A female (albeit signalling refusal) barely distracted them (Tennent 1987). Same-sex confusion, however, is more likely to occur between

different species especially different genera. For some examples, Heitzman (1964) reported a male-male, pyrgine skipper-noctuid moth courtship, and Shields and Emmel (1973) described a same-sex courtship between a male *Papilio* (Papilionidae) and male *Euphydryas* (Nymphalinae). Neither of these resulted in copulation. Earlier, Rothschild (1911) and de Fleury (1934) had documented two butterfly intrasexual (male-male) copulations. Although both involved partners of different genera, the couplings were between members of the same subfamilies (the Nymphalinae and Satyrinae, respectively). Newman (1946) documented one involving a sphingid moth and papilionid butterfly, and Tennent (1994) reported two same-sex matings in Sweden (Polyommatainae) and Yugoslavia (Pierinae) – the latter pairing within *Pieris* is noteworthy as it involved close species. Unlike many documented same-sex copulations that involved distant taxa, the proposed example illustrated by Clyne (2000) is also congeneric, and from the Pieridae.

As a matter of interest, there seem no records of female intrasexual courtships, and coupling would seem physically impossible. Given that males initiate courtship, even when the female first approaches the male (Scott 1973), begs the question that female-female courtship would not occur, unless perhaps, where one participant is a mosaic gynandromorph showing sexual behavior contrary to its predominant wing patterns.

### Observation

Clyne (2000, pp.56-57) illustrated a mating pair of Australian *Catopsilia* (Pieridae: Coliadinae) resting on a *Cassia* leaf. She had labelled the couple under the common name, 'Lemon migrant' (*C. pomona* Fabr.), but had not specified the sexes. No doubt the uppermost, yellow, adult had been presumed a summer form female or a yellow, winter female, and the lower adult, the winter form male of this very common species (for discussion of seasonal polyphenism and general biology see Rienks 1999). This obvious and 'common sense' assumption was based on her having labelled a yellow adult in a second photo as female. However, a close inspection reveals an anomalous mating.

### Discussion

In Clyne's photograph, the uppermost adult is almost certainly the carrier of the couple (Scott 1973, Shields & Emmel 1973). It is basically cadmium-yellow beneath. If it were a summer form female of *C. pomona*, the forewing (FW) terminal band would appear less regular than in the individual depicted, and one would expect a prominent hindwing (HW) terminal band which is absent. However, if it were a dry season (winter) form (with a yellow underside) the FW band sculpturing would normally extend along the veins to the wing edges. The adult is poorly matched to either form or their variants. Indeed, the presence of dark (non-silvered) cell rings beneath conclusively eliminates *C. pomona*.

The reduced underside pattern closely matches a male of *C. scylla* (L.) or perhaps *C. gorgophone* (Boisduval). Indeed, the (upperside) broad FW terminal band matches both sexes of *C. scylla* equally well, but not *C. gorgophone*, and with available background lighting it appears that the FW postmedian band is absent, thus inferring a male. In support of this, Clyne's lower photo (labelled 'female') shows a yellow adult feeding at *Buddleia* flowers. Remarkably, it seems to be the same individual as the one photographed in copulation. Compare, for example, the distinctive HW tear between veins CuA1 and 1A+2A. Because of the background lighting, the upperside pattern is more clearly transmitted in this image, and convincingly suggests a male of *C. scylla*.



Males of both *C. gorgophone* and *C. scylla* are normally less heavily marked beneath (than females), providing further evidence of the sex involved. In addition, in normal matings within the subfamily Coliadinae, and indeed the Pieridae as a whole, the male is almost always the carrier (Shields & Emmel 1973; some Australian examples in Dunn 2000) and, hence, the uppermost adult would almost certainly be male. Within *Catopsilia*, Shields & Emmel (1973) and Dunn (2000) listed the male as the carrier in *C. florella* Fabr. and *C. pomona*, respectively. By deduction, if the feeding adult in the lower photo is indeed the same individual (as argued) it must be male too – not female as labelled.

The seemingly, paired lower adult is clearly not a female *hinda* form of the *C. scylla/gorgophone* sibling group as might be expected. Based on the conspicuous striations beneath it can only be *C. pyranthe* (L.), and since it is the carried partner, presumably a female. The angular wing shape, however, suggests a male, and the dark (not pink) antennae, a summer form. Clyne's photo, thus, apparently depicts a male-male intrasexual mating between *C. scylla* and *C. pyranthe*, with the latter as the receptive (submissive) partner. Based on the available World data, heterospecific matings in the Pieridae are extremely rare (Shields & Emmel 1973, Dunn 1996).

### Possible Explanations

In terms of mate locating strategies, males of *Catopsilia* are patrollers. This generalisation is based on personal observations of five species. Namely, *C. pomona* (in The Philippines, Thailand, Malaysia, Singapore, Borneo, & Aust.), *C. florella* (in Egypt), *C. pyranthe* (in Thailand, Malaysia, & Aust.), *C. scylla* (in The Philippines, Thailand, Malaysia, Singapore, & Aust.), and *C. gorgophone* (in Aust.). Unlike perching species, patrolling species need a large home range. They would be expected to mate quickly once an available partner is recognised (Dunn 1996). Courtship refusal has not yet been documented in this genus, but probably involves the abdomen-erection posture accompanied by flattened wings, similar to that assumed by *Pieris rapae* (Obara 1970). This posture typifies many other pierids including coliadines (Scott 1973).

Since *C. pyranthe* and its close mimic, *hinda* are both geographically and seasonally sympatric in Queensland, species recognition is a mandatory requirement for species perpetuation. This probably occurs by visual cues and olfactory signals. Even though males of the *hinda* form would be an exceptional encounter because of their extreme rarity – none has been wild-caught (Dunn 1995) – those of the normal bicolored phenotype should be expected to distinguish the *hinda* sexes by olfactory means. Males of both color forms and allied species bear FW dorsal, scent hairs. These overlay the ovoid patch of sex scales on the HW above (between veins Sc+R1 and Rs), which are most likely used to entice the female during courtship.

False visual cues were seemingly initially responsible. The male *C. scylla* had almost certainly interpreted the *C. pyranthe* to be a *hinda* female. Perhaps artificial environmental factors, such as a constrained home range, had overridden the olfactory signals indicating the pursued individual was male. Alternatively, the pursued adult's pheromones were faulty or ambiguous, or the pursuer's olfactory receptors failed. The male *C. scylla* may also have persevered with this incorrect coupling in the absence of females of its own kind, within its home range over a long period of time. In response, the male *C. pyranthe* may have submitted after becoming confused and exhausted.

Moreover, in the case of same-sex courtships, males will sometimes mimic female refusal signals to deter the mistaken individual. In laboratory cultures of *Pieris brassicae*, resting males sometimes resorted to mimicking the female pierid rejection posture when they could not escape the attention of another male (David & Gardiner 1961). Similarly, males of *Precis coenia*

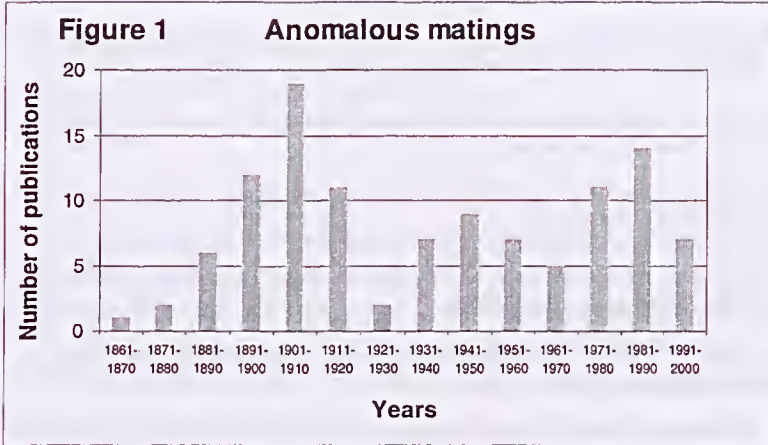
(Nymphalinae) may flutter their wings to mimic the female rejection dance (Scott 1973). The male *C. pyranthe* probably endured prolonged courtship from an aggressive suitor, and, like *Pieris*, may have resorted to mimicking female signals of refusal. The 'female' signals perhaps visually convinced the male *C. scylla* that he was courting a mildly unreceptive female that might submit. There has been strong evolutionary selection for persistent males in butterflies, as males that can entice both receptive and mildly unreceptive females to mate achieve more matings (Scott 1973), and indeed, some females may actually assess male vigour through initial rejection behavior (Rutowski 1979). In this case the aggressor persevered with the courtship resulting in an incorrect, and a time and resource wasted union.

Field experience dictates that it would be unlikely for the same individual to have been photographed twice during separate prolonged activities – feeding and mating – in the wild. Since this seems to have occurred, it is more likely the butterflies were confined. If they had paired in a butterfly farm for example, the confined artificial conditions, including air-conditioning and altered lighting, might confuse sexual recognition among some individuals of sibling species. Moreover, mating at different times of the day (which would be affected in captivity) has been suggested as a potential isolating mechanism among closely related species, but Scott (1973) reported no confirmed examples in the literature. One intrasexual mating was attributed to artificial lighting in a greenhouse (Newman 1946), but the others remain unexplained. Lighting, in combination with inherent biochemical faults, may have contributed in part to this proposed, interspecific same-sex mating in *Catopsilia*, but there seems no report of this occurring in the many commercial butterfly houses operating around the world. Of more concern, it is possible some airborne organic pollutants may mimic specific insect pheromones, causing courtship anomaly in select species.

#### Appendix:

Figure 1 shows 113 publications (known to me) recording anomalous sexual interactions – natural incidents involving interspecific, and intrasexual matings, as well as mistaken courtships among World butterflies and moths – grouped by decade, spanning a 140-year period from 1861-2000. Each included publication contains original observations, and the year of publication (allocated date) was usually close to the observation date, and usually fell within the allocated decade. Since many papers referred to older sources, tallies for earlier decades are reckoned more complete than the final decade(s). There has been no overall increase in records over the last 140 years.

A slightly higher numbers were published between 1970-90, and in particular, the three decades at about the turn of the last century. The significance if any, of the turn of the 20<sup>th</sup> C. increase is not clear. Dunn & Dunn (1990) revealed an exponential increase in the number of Australian butterfly records compiled between 1880-1990, and their figure also corroborated an irregular increase in butterfly records between 1900-1910. This decade probably showed a fashionable boom in observations in Australia, and presumably reflected a global trend. Hence, during that era, the increase (above predicted levels) in records of anomalous matings probably correlated with a global (western) increase in field observations and collecting of Lepidoptera. Recently, Moulds (1999) showed an exponential growth of papers on Australian butterflies since the 1960s. This trend likewise probably applied to other western societies too, but did result in a correlated increase in publications on coupling abnormality, which might be expected, based on probability. As a result, there seems no evidence that environmental decay through use of organic pesticides and related chemicals, World habitat loss and accompanying degradation over the last century or so has contributed to an increase in anomalous coupling behavior among Lepidoptera.



**Acknowledgements**

Thanks to E.D. Edwards for assistance, and W.J. Tennent (*vide* Editor, W. Jarvis' note in Tennent 1994) for providing details of half the references (57)\* used to create the figure (the remaining 56 publications were compiled by the writer over several years).

**\*Personal communication:** I am grateful to John Tennent for the supply of the significant unpublished document that came to me second hand, and has been used with the knowledge and approval of its author.

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## Australian Journal of Entomology Volume 40, Part 4, 2001

The Australian Entomological Society publishes the *Australian Journal of Entomology* quarterly. The Entomological Society of Victoria is an affiliated society and will, in future, publish the contents of the Journal for the wider interest of its members.

### SYSTEMATICS

**RB Halliday:** Mesostigmatid mite fauna of Jenolan Caves, New South Wales (Acari: Mesostigmata)

**T Ekrem:** Diagnoses and immature stages of some Australian *Tanytarsus* van der Wulp (Diptera: Chironomidae)

**RB Halliday:** Systematics and biology of the Australian species of *Balaustium* von Heyden (Acari: Erythracidae)

**CAM Reid:** *Galerucella placida* Baly in Australia (Coleoptera: Chrysomelidae: Galerucinae)

**HC Proctor:** *Megninia casuaricola* sp. n. (Acari: Analgidae), the first feather mite from a cassowary (Aves: Struthioniformes: Casuariidae)

**A Kallies:** New records and a revised checklist of the Australian clearwing moths (Lepidoptera: Sesiidae)

### CYTOLOGY

**A Maryanska-Nadachowska, GS Taylor & VG Kuznetsova:** Meiotic karyotypes and structure of testes in males of 17 species of Psyllidae: Spondyliaspidae (Hemiptera: Psylloidea) from Australia

**A Maryanska-Nadachowska, VG Kuznetsova & GS Taylor:** Meiotic karyotypes and structure of testes in males of 12 species of Psyllidae: Acizziinae, Carsidaridae and Trioziidae (Hemiptera: Psylloidea) from Australia

### ECOLOGY

**DP Logan, PG Allsopp & MP Zalucki:** Effect of body size on fecundity of Childers cane grub, *Antitrogus parvulus* Britton (Coleoptera: Scarabaeidae)

**SL Goldson, MR McNeill, JR Proffitt & DB Baird:** Seasonal variation in larval-instar head-capsule sizes of Argentine stem weevil, *Listronotus bonariensis* (Kuschel) (Coleoptera: Curculionidae)

**MJ Pieloor & JE Seymour:** Factors affecting adult diapause initiation in the tropical butterfly *Hypolimnas bolina* L. (Lepidoptera: Nymphalidae)

### BEHAVIOUR

**AT Hardy, BA Franzmann & MW Sutherland:** Artificial infestation of sorghum spikelets with eggs of *Stenodiplosis sorghicola* (Coquillett) (Diptera: Cecidomyiidae) by water injection

### PEST MANAGEMENT

**N Beveridge and JA Elek:** Insect and host-tree species influence the effectiveness of a *Bacillus thuringiensis* ssp. *tenebrionis*-based insecticide for controlling chrysomelid leafbeetles.

## Journal of the Entomological Research Society Volume 3, Part 3, 2001

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Bosák, J., Hradský, M., Some Remarks on the Distribution of Robber Flies (Diptera: Asilidae) in Turkey.

Kiliç, A.Y., The Tabanidae (Diptera) Fauna of Kütahya Province of Turkey.

Sarıbiyik, S., New Records of the Subfamily Milesiinae (Diptera: Syrphidae) from Turkey.



### Members Night Program, 14 December 2001:

- Butterflies of Mindanao and Luzon (Philippines) – Video by K. Dunn
- Display of digital images of insects collected from Ocean Grove Nature Reserve on 25 November 2001
- Exhibits and displays by various members
- Demonstration of insect setting techniques (Time permitting)



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## DIARY OF COMING EVENTS

**Friday 14 December General Meeting - Members Night**  
Members will give short talks and slide presentations (refer page 108 for details)  
Please bring a plate. Tea and Coffee will be provided

Scientific names contained in this document are *not* intended for permanent scientific record, and are not published for the purposes of nomenclature within the meaning of the *International Code of Zoological Nomenclature*, Article 8(b). Contributions may be refereed, and authors alone are responsible for the views expressed.